**Comparison of patient reported outcome measures between home and hospital rehabilitation of patients following a hip fracture**

Abstract

Background

The anticipated increase in hip fracturs (HF) due to the aging of the population and the rise in attractiveness of healthcare services that are provided at home, following the COVID-19 pandemic, emphasize the pressing need to compare the outcomes of home vs hospital HF rehabilitation. Research that compares the two setting has focused primarily on clinical outcomes and not on patient reported outcomes (PROs). The aim of this study is to evaluate PROs of HF patients in the two rehabilitation settings.

Methods

A longitudinal observational multi-center trial of HF patients. PROs were measured using the SF36 questionnaire that evaluates eight topics: physical functioning, physical role-limitation, bodily-pain, general-health, vitality, social functioning, emotional role-limitation and mental-health. Questioning was performed three times: 24-48 hours after surgery, two weeks, and three months later. The first questioning was retrospective and reflected pre-fracture health-quality and functionality. Descriptive statistics and mixed effect logistic-regression were used to compare the two settings.

Results

 A total of 86 HF patients participated in the study: 45 hospital and 41 home. With the exception of bodily pain, no statistically significant (P<0.05) differences were found when comparing the two groups improvement in the measures of the SF36, from pre-fracture status to recovery, three months post facture. In both groups, the physical and the mental score declined two weeks after the HF, in comparison to the pre-fracture status. The patients' health status improved somewhat three months after the fracture, but did not return to the pre-fracture score.

Conclusion

PROs of home vs. hospital rehabilitation are similar and suggest that for suitable patients rehabilitation at home can be as effective as hospital rehabilitation. PROs enable for a richer and comprehensive understanding of health outcomes of HF patients in different rehabilitation settings. This process, of patient centered care, can improve quality healthcare in a growing population of patients.

**What is already known on this topic?** Following the COVID-19 pandemic there has been an increase in the discharge of hip fracture patients to home rehabilitation vs hospital rehabilitation. Research that compares the two setting of rehabilitation has focused primally on clinical outcomes and not on patient reported outcomes (PROs). PROs can enable for a broader understanding of the patient experience and outcomes throughout the recovery process.

**What this study adds?** Patient reported outcomes of home vs. hospital rehabilitation are similar and suggest that home rehabilitation is as effective as the later.

**How this study might affect research, practice or policy**?  The findings from this study can help the medical staff when deciding where to discharge hip fracture patient and support policy planning regarding the preparedness for the growing need of rehabilitation units.

Introduction

Hospital admission rates of patients with hip fracture (HF) have increased substantially in the past decade (1). In older adults, HF is associated with poor outcomes, high costs, and a long rehabilitation process (2,3). Post-HF rehabilitation has been designed to reduce the effect of fractures on long-term disability (4), decrease the risk of mortality (5), and improve patients' quality of life (6).

Rehabilitation following an acute HF hospitalization can be performed in hospital or at home (7). The decision to rehabilitate at home or hospital is dependent on social, medical, and cognitive determinants. Patients are referred for home rehabilitation, if they have a caregiver at home, do not require close medical attention, and/or are permitted to ambulate (8).

Multidisciplinary rehabilitative care has been reported to have a positive outcome in patients recovering from a HF (9,10). This treatment includes healthcare delivery by multiple health professionals, such as nurses, physicians, physiotherapists, occupational therapists, social workers, and dietitians. In Israel, post-HF rehabilitation is multidisciplinary and cost-free in both settings (8).

Rehabilitation in both settings has its objective advantages and disadvantages. Hospitalization of older adults with HF has been associated with an increased risk of infections (11) and cognitive and functional deterioration (12,13). In contrast, home care has been designed to reduce iatrogenic complications and hospitalization-related expenses and honor patients' wishes to stay at home (14). However, rehabilitation at home may lead to less medical attention and a burden on family caregivers (15–17).

Due to the aging of the population, the need for rehabilitation, in general, and home-based rehabilitation has increased in recent years (18). This change became increasingly evident when the advent of the COVID-19 pandemic made older adults afraid to leave their homes for treatment in medical facilities due to the risk of infection (19). Outcome comparisons of the two settings can help healthcare professionals recommend the best-suited rehabilitation setting for patients with HF and support policy planning by improving the preparedness for the growing need of rehabilitation units (14).

Previous studies on the comparison of both settings primarily focused on clinical and functional outcomes (20,21) but not on outcomes that are meaningful to the patient. In recent years, the use of patient-reported outcomes (PROs) in healthcare has increased (22,23). PROs are measured using validated questionnaires that assess the symptoms, function, and quality of life from the patient’s perspective. Therefore, the need to measure patient-valued outcomes is warranted (24). The aging global population and predictable increase in the incidence of HFs emphasize the need to establish outcome sets that would be most meaningful to patients. This study sought to evaluate PROs of patients with HF in home-based and hospital-based rehabilitation settings.

**Methods**

*Study design*

This study was a longitudinal observational multi-center trial among patients with HF. The study was designed based on the Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) statement (25).

*Study-Setting*

Study participants were recruited from the two largest tertiary medical centers in the Middle East, the Sheba Medical Center and Hadassah Medical Center, during the period from December 2021 to November 2022.

*Participants*

Inclusion criteria: (a) age 60 years old and older; (b) patients that had undergone stabilization of femoral neck fractures; (c) are able to understand and sign the informed consent form; (d) understand Hebrew. Exclusion criteria: (a) patients with pathological fractures; (b) sever hearing disabilities.

 Participants were recruited from two groups: Group 1 included patients that were discharged from the orthopedic department to their home where a staff member from the rehabilitation at home team met them within 24-48 hours. Group 2 included patients that were admired to the rehabilitate department directly from the orthopedic or the emergency department. Patients were allocated to a specific group according to the decision of the medical team and not for research purpose. The setting was decided based on meetings of the socialworker, nurse and medical team with the patient and his or her family. The discharge planning is decided by the medical team and is based on clinical and social criteria, such as the patients' comorbidities, cognitive status and social support. Group 2 also participated as a control group in a different study.

The rehabilitation treatment in both settings is similar and includes an integrative treatment approach that is carried out by a multidisciplinary staff of geriatric, orthopedic and rehabilitation specialists, nurses, dietitians, physiotherapy sessions, and occupational, emotional and speech therapy in needed.

*Data collection*

At the baseline demographic and clinical data were collected from the patients' hospital and community medical files, including co-morbidities, functional status prior to the fracture and social support.

*Outcome Measurements*

PROs were measured using the short form (SF)36 questionnaire. The SF36 has been found to be suitable as a PRO in HF patients(26) and evaluating recovery after lower extremity trauma.(27) Though the SF36 is a general questionnaire it addresses specific conditions.(28,29) It consists of 36 questions in eight topics: physical functioning, physical role limitation, bodily pain, general health, vitality, social functioning, emotional role limitation and mental health. Interpretation of the results can be obtained from a calculation of each topic and a summarization of several topics that generate a physical component score (PCS) and the mental component score (MCS).(30,31)

Measurements were performed three times: 24-48 hours after surgery while hospitalized (T1), two weeks later (T2), while hospitalized or by phone, and three months later by phone (T3). (See Figure 1 for timeline). The first questioning is retrospective and reflects health-quality and functionality before the fracture.(32)

*Statistical measures*

Descriptive statistics were used to outline the patients' demographics and medical history. T-test and Chi-Square were used to detect differences in characteristics of the groups. SF36 data were scaled so possible scores ranged from 0 (poor health) to 100 (excellent health) for the eight domains. PCS and MCS that have been reported to be responsive in orthopedic conditions(35) were also calculated. The calculations were done according to the RAND Corporation web site ([36-Item Short Form Survey (SF-36) | RAND](https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form.html)) and the oblique (correlated) factor solution that is recommended among orthopedic patients.(36)

Mixed effect logistic regression was utilized for comparison of PROs outcomes. The mean scores were adjusted to age, sex and Charlson co-morbidity index (CCI),(37) a predictive score of health outcomes in HF patients.(3,38) The PROs were not adjusted to fracture and surgery type as others have reported no association between health-related quality of life and surgical approach.(39–41) The minimal important difference(MCID) was also calculated, assuming that a change of 9 points in one of the subscales and 2 points on the PCS and MCS of the SF36 is considered as the MCID.(42,43) MCID was compared between the two groups and the times of questioning: pre-fracture and two weeks after (T1-T2), two weeks and three months after the fracture (T2-T3) and pre-fracture status and three months post-fracture (T1-T3).

The data were managed with Excel 2016 and analyzed using IBM SPSS Statistics for Windows Version 27 and Stata version 15.0.

*Sample size*

 Sample size was performed using Winpepi 11.65. Assuming that a change of 9 points in one of the subscales of the SF36 is considered the MCID.(42) To detect a difference of 9 points on the subscale, assuming a standard deviation of 10 points and a power of 80% and P<0.05, sample size of 20 in each group is required. Accounting for the possible loss of follow-up due to the unfortunate increased risk for deterioration and mortality following a HF(44) we set a goal to increase each group by at least 50% percent to make a total of a minimum 30 participants in each subgroup.

*Ethics approval and consent of participate*

The study was approved by the ethics committees of Sheba (#SMC-7933-20) and Hadassah Medical Centers (#HMO-0691-21). All participants provided written informed consent forms before enrolling in the study.

Results

*Characteristics of participants*

 A total of 86 HF patients participated in the study: 45 hospital and 41 home (see Figure 2 for description of study participants’ groups and follow up 2 weeks and 3 months later). The two groups had similar characteristics (P value>0.05) (see Table 1) with the exception of age and CCI. No significant differences (P value>0.05) in demographic, clinical and social characteristics were found between patients who participated in the study to those that were excluded from the study (n=141) for self-reported reasons such as health issues, hearing difficulties, language barriers or other reasons.

Table 1: Comparison of characteristics of inpatient and home groups

|  |  |  |  |
| --- | --- | --- | --- |
|  | Inpatient rehabilitation | Home rehabilitation | P-Value |
| Age, Mean (SD) | 82.4 (7.6) | 77.24 (7.7) | 0.02 |
| Woman, n (%) | 33 (73) | 25 (61) | 0.183 |
| Charlson co-morbidity score, Mean (SD) | 5.3 (1.6) | 4.5 (1.8) | 0.023 |
| Days from hospitalization to surgery, Mean (SD) | 1.4 (1.2) | 1.16 (0.9) | 0.96 |
| Days from hospitalization to rehabilitation, Mean (SD) | 7.02 (4.2) | 8.3 (4.4) | 0.12 |
| Extracapsular fracture, n (%)  | 33 (73) | 29 (71) | 0.81 |
| PFNA (or other nailing) n (%) | 33 (73) | 31 (75) | 0.21 |

*PROs outcomes*

Response rates were 100%, 98% and 91% at T1, T2 and T3 respectively. Figure 3 presents the physical and mental summary scores of the participants, in the home and hospital groups, adjusted to age, sex and CCI. Between the two groups, no significant differences were found between in the scores (P<0.05) when comparing the PROs scores: pre-fracture (T1), two weeks post fracture (T2) and three months later (T3). In both groups, the physical and the mental score plummet two weeks after the HF (T2), in comparison to the pre-fracture status (T1). As presented in Table 2, this deterioration was MCID in all of the health domains and the two summary domains, PCS and MCS. The patients' health status improved somewhat three months after the fracture (T3), this difference was MCID primarily for the physical health domains (PCS, physical function and pain) and the MCS.

With the exception of physical function, in all of the SF36 health scores, the home and the inpatient group had similar decline two weeks after their fracture in comparison to their pre-fracture status. And with the exception of bodily pain, no statistically significant (P<0.05) differences were found in the improvement from the pre-fracture status to the recovery three months post facture in both groups.

Table 2: Comparison of the difference of the PROs scores between times (T1-T2, T2-T3, T1-T3) in the inpatient and home group adjusted to sex, age and CCI

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Delta between times | PF, Mean (SE)  | RL, Mean (SE) | BP, Mean (SE) | GH, Mean (SE) | V, Mean (SE) | SF Mean (SE)  | EL Mean (SE) | MH Mean (SE) | PCS Mean (SD) | MCS Mean (SD) |
| Home | T1- T2 | 61.34\* | 73.65 | 38.14 | 12.39 | 21.76 | 31.34 | 19.89 | 15.4 | 34.86 | 16.35 |
| T2 -T3 | -34.38 | -38.16 | -8.34 | 0.27 | -7.27 | -3.18 | 0.17 | -2.41 | -14.99 | -2.49 |
| T1- T3 | 26.92 | 35.47 | 29.8\* | 7.84 | 15.01 | 28.16 | 20.06 | 12.98 | 20.45 | 13.87 |
| Hospital | T1- T2 | 46.38\* | 56.85 | 25.41 | 14.77 | 16.09 | 24.26 | 16.11 | 9.31 | 27.38 | 12.15 |
| T2 -T3 | -30.13 | -24.96 | -17.31 | -9.1 | -8.42 | -12.18 | -13.81 | -4.07 | -14.67 | -6.19 |
| T1- T3 | 16.25 | 31.89 | 8.1\* | 5.67 | 7.67 | 18.08 | 2.3 | 5.24 | 12.71 | 5.96 |

\*Values in a row that differ statically (P<0.05) when compared between groups, home and hospital, at the 5% probability level according to the multi analysis regression. PF- physical functioning, RL- physical role limitation, BP- bodily pain, GH-general health, V- vitality, SF social functioning, EL-emotional role limitation, MH- mental health. PCS- physical component score, MCS-mental component score.

Discussion

The findings suggest that the setting of the rehabilitation does not influence PROs outcomes. Thus, the choice for the rehabilitative cite should be based on other factors, such as patient and their family/care givers preference and abilities to provide homecare and the patients' medical condition. The hospital group had a lower SF36 score, at the pre-fracture evaluation, in comparison to the home rehabilitation. This is not surprising, patients with more co-morbidities are often refereed to inpatient rehabilitation as opposed to home.(45,46) To enable for a more balanced comparison of the two groups, the outcomes were controlled for age, sex and CCI. However, although the preliminary SF36 score of the home rehabilitation was higher than the inpatient population, the outcomes were mostly similar (P>0.05).

The findings from this study are in keeping with results of previous studies that compared clinical outcomes, such as 30-day readmission rates, mortality rates during or 90 days after rehab, and functional improvement, and found no significant difference of home rehabilitation and hospital care (20,47–50). In fact, home rehabilitation patients have been reported to experience less adverse events(51) such as infections.(52) It has also been found to have a positive effect, in the early stages of rehabilitation, on patient's balance confidence(17) and self-efficacy,(53) improved functionality,(54) better time-space orientation and collaboration(50) and even on caregivers burden.(55) These findings, are consistent with studies that compare PROs of acute patients in home vs hospital,(16) and suggest that HF patients can be managed at home while achieving equivalent outcomes and utilizing less resources in comparison to inpatient-hospital rehabilitation.(56,57) This information is especially valuable due to the shortage of rehabilitation beds in long term facilities.(58)

PROs data provided a richer understanding of HF patients' outcomes, their functionality and wellbeing, throughout time. As expected, patients' physical and functional status was altered by the fracture. However, the findings in this study suggest that a HF also has a toll on general health, the emotional, mental, and social-functioning. A sharp decline in SF36 scores post HF and only a partial recovery after rehabilitation has been reported before.(40,41) Jaglala(59) reports the same trend continues six months post fracture.

*Strengths and limitations*

The study demonstrated several strengths that were not reported previously. Others (14) have stressed the importance of conducting studies that compare the outcomes of home vs hospital care. This study examined PROs of HF patients in home vs hospital rehabilitation. In contrast to previous studies, that compared quality of life of HF patients in home rehabilitation to no treatment(17,51,55,60–63) or were consistent of a small sample(50,64) we measured PROs of inpatient and home rehabilitation, thus enabling for a more "balanced" comparison of the two rehabilitation settings. This study had relatively high response rates in all age-groups in comparison to other HF PRO studies (54%-15%) that reported a lack of representation of older adults.(65–67) This could be explained by the use of a single questionnaire that has caused less survey fatigue(68) and the use of sequential methods, in person and phone questioning, that has been associated with higher survey response rates.(69) Contrary to other studies(70) we collected patient pre-fracture PROs, and could evaluated the influence of the HF on the patient's. To our knowledge, this is the first PRO study in Israel to focus on real-practice rehabilitation settings of HF patients. The study was done in two large tertiary hospitals and the results can serve as a benchmark for comparison of future PRO in HF patients.

A possible limitation is that naturally this study cannot evaluate if patients who received rehabilitative care in the hospital would have made the same kind of improvement if they were cared for at home and vice versa. Additionally, factors such as socioeconomic status may have also influenced the referral of patients to home or hospital rehabilitation. The questioning at three months and some of the questioning at 2 weeks were done by telephone interviews. Previous studies have reported that telephone-administrated questionnaires provide for a more optimistic health related quality of life.(71–73)This may suggest that HF patients' recovery is worse than the outcomes described in the study.

The COVID-19 pandemic has had an impact on rehabilitation services. A growth in the use of home-based rehabilitation and tele-rehabilitation were designed to ensure the safety of patients and their staff.(74) In keeping with this new reality, it is important to study the outcomes and effectiveness of HF rehabilitation in different settings. The findings from this study can help with deciding where to discharge the patient and support policy planning regarding the development of future rehabilitation services.

*Conclusion*

Patient reported outcomes of home rehabilitation vs inpatient rehabilitation are similar and suggest that this setting is as effective as the later. PROs enable for a richer and comprehensive understanding of healthcare outcomes of HF patients in different rehabilitation settings. This process, of patient centered care, can improve quality healthcare in a growing population of patients.

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